In the Claims:

Please cancel claim 557 without prejudice.

Listed below is a clean copy of amended claims. A marked-up copy of the amended claims is provided in an accompanying document.

531. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more heaters to at least a portion of the formation;

allowing the heat to transfer from the one or more heaters to a part of the formation;

controlling a pressure and a temperature in at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure;

maintaining the controlled pressure of at least about 2.0 bars absolute; and

producing a mixture from the formation.

532. (amended) The method of claim 531, wherein the one or more heaters comprise at least two heaters, and wherein controlled superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons in the part of the formation.

533. (amended) The method of claim 531, further comprising controlling formation conditions, wherein controlling formation conditions comprises maintaining a temperature in the part of the formation in a pyrolysis temperature range of about 270 °C to about 400 °C.

534. (amended) The method of claim 531, wherein at least one of the heaters comprises an electrical heater.

535. (amended) The method of claim 531, wherein at least one of the heaters comprises a surface burner.

536. (amended) The method of claim 531, wherein at least one of the heaters comprises a flameless distributed combustor.

537. (amended) The method of claim 531, wherein at least one of the heaters comprises a natural distributed combustor.

539. (amended) The method of claim 531, wherein providing heat from the one or more heaters to at least the portion of the formation comprises:

heating a selected volume (V) of the coal formation from the one or more heaters, wherein the formation has an average heat capacity (Cv), and wherein the heating pyrolyzes at least some hydrocarbons in the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

541. (amended) The method of claim 531, wherein allowing the heat to transfer from the one or more heaters increases a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m ºC).

554. (amended) The method of claim 531, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

558. (amended) The method of claim 531, further comprising controlling formation conditions to produce a mixture of condensable hydrocarbons and H_2, wherein a partial pressure of H_2 in the mixture is greater than about 0.5 bar.

560. (amended) The method of claim 531, further comprising altering a pressure in the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.

562. (amended) The method of claim 531, further comprising:

providing hydrogen (H_2) to the part of the formation to hydrogenate hydrocarbons in the part of the formation; and

heating a portion of the part of the formation with heat from hydrogenation.

564. (amended) The method of claim 531, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

565. (amended) The method of claim 531, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part of the formation is substantially uniform.

568. (amended) The method of claim 531, further comprising providing heat from heaters to at least a portion of the formation, wherein the heaters are located in the formation in a unit of heaters, and wherein the unit of heaters comprises a triangular pattern.

569. (amended) The method of claim 531, further comprising providing heat from heaters to at least a portion of the formation, wherein the heaters are located in the formation in a unit of heaters, wherein the unit of heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

570. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more heaters to at least a portion of the formation;

allowing the heat to transfer from the one or more heaters to a part of the formation to raise an average temperature in the part of the formation to, or above, a temperature that will pyrolyze hydrocarbons in the part of the formation;

producing a mixture from the formation; and

controlling API gravity of the produced mixture to be greater than about 25 degrees API by controlling average pressure and average temperature in the part of the formation such that the average pressure in the part of the formation is greater than the pressure (p) set forth in the following equation for an assessed average temperature (T) in the part of the formation:

$$p = e^{[-44000/T + 67]}$$

where p is measured in psia and T is measured in Kelvin.

573. (amended) The method of claim 570, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons in the part of the formation.

574. (amended) The method of claim 570, wherein controlling the average temperature comprises maintaining a temperature in the part of the formation in a pyrolysis temperature range of about 270 °C to about 400 °C.

575. (amended) The method of claim 570, wherein at least one of the heaters comprises an electrical heater.

576. (amended) The method of claim 570, wherein at least one of the heaters comprises a surface burner.

577. (amended) The method of claim 570, wherein at least one of the heaters comprises a flameless distributed combustor.

578. (amended) The method of claim 570, wherein at least one of the heaters comprises a natural distributed combustor.

579. (amended) The method of claim 570, further comprising controlling a temperature in at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

581. (amended) The method of claim 570, wherein providing heat from the one or more heaters to at least the portion of the formation comprises:

heating a selected volume (V) of the coal formation from the one or more heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons in the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

583. (amended) The method of claim 570, wherein allowing the heat to transfer from the one or more heaters increases a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).

595. (amended) The method of claim 570, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

598. (amended) The method of claim 570, further comprising controlling formation conditions to produce a mixture of condensable hydrocarbons and H_2, wherein a partial pressure of H_2 in the mixture is greater than about 0.5 bar.

600. (amended) The method of claim 570, further comprising altering a pressure in the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.

602. (amended) The method of claim 570, further comprising:

providing hydrogen (H_2) to the part of the formation to hydrogenate hydrocarbons in the part of the formation; and

heating a portion of the part of the formation with heat from hydrogenation.

604. (amended) The method of claim 570, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

605. (amended) The method of claim 570, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part of the formation is substantially uniform.

608. (amended) The method of claim 570, further comprising providing heat from heaters to at least a portion of the formation, wherein the heaters are located in the formation in a unit of heaters, and wherein the unit of heaters comprises a triangular pattern.

609. (amended) The method of claim 570, further comprising providing heat from heaters to at least a portion of the formation, wherein the heaters are located in the formation in a unit of heaters, wherein the unit of heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

610. (amended) A method of treating a coal formation in situ, comprising:

providing heat to at least a portion of a coal formation such that a temperature (T) in a substantial part of the heated portion exceeds 270 ºC and hydrocarbons are pyrolyzed in the heated portion of the formation;

controlling a pressure (p) in at least a substantial part of the heated portion of the

formation;

wherein $p_{bar} > e^{[(-A/T)+B-2.6744]}$;

wherein p is the pressure in bar absolute and T is the temperature in Kelvin, and A and B are parameters that are larger than 10 and are selected in relation to the characteristics and composition of the coal formation and on the required olefin content and carbon number of the pyrolyzed hydrocarbon fluids; and

producing pyrolyzed hydrocarbon fluids from the heated portion of the formation.

623. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more heaters to at least a portion of the formation;

allowing the heat to transfer from the one or more heaters to a part of the formation to raise an average temperature in the part of the formation to, or above, a temperature that will pyrolyze hydrocarbons in the part of the formation;

producing a mixture from the formation; and

controlling a weight percentage of olefins of the produced mixture to be less than about 20 % by weight by controlling average pressure and average temperature in the part of the formation such that the average pressure in the part of the formation is greater than the pressure (p) set forth in the following equation for an assessed average temperature (T) in the part of the formation:

$$p = e^{[-57000/T + 83]}$$

where p is measured in psia and T is measured in Kelvin.

665. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more heaters to at least a portion of the formation;

allowing the heat to transfer from the one or more heaters to a part of the formation to raise an average temperature in the part of the formation to, or above, a temperature that will pyrolyze hydrocarbons in the part of the formation;

producing a mixture from the formation; and

controlling hydrocarbons having carbon numbers greater than 25 of the produced mixture to be less than about 25 % by weight by controlling average pressure and average temperature in

the part of the formation such that the average pressure in the part of the formation is greater than the pressure (p) set forth in the following equation for an assessed average temperature (T) in the part of the formation:

$$p = e^{[-14000/T + 25]}$$

where p is measured in psia and T is measured in Kelvin.

666. (amended) The method of claim 665, wherein the hydrocarbons having carbon numbers greater than 25 of the produced mixture are controlled to be less than about 20 % by weight, and wherein the equation is:

$$p = e^{[-16000/T + 28]}.$$

D21

667. (amended) The method of claim 665, wherein the hydrocarbons having carbon numbers greater than 25 of the produced mixture are controlled to be less than about 15 % by weight, and wherein the equation is:

$$p = e^{[-18000/T + 32]}.$$

668. (amended) The method of claim 665, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons in the part of the formation.

669. (amended) The method of claim 665, wherein at least one of the heaters comprises an electrical heater.

670. (amended) The method of claim 665, wherein at least one of the heaters comprises a surface burner.

671. (amended) The method of claim 665, wherein at least one of the heaters comprises a flameless distributed combustor.

672. (amended) The method of claim 665, wherein at least one of the heaters comprises a natural distributed combustor.

673. (amended) The method of claim 665, further comprising controlling a temperature in at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

D21

674. (amended) The method of claim 673, wherein controlling the temperature comprises maintaining a temperature in the part of the formation in a pyrolysis temperature range of about 270 °C to about 400 °C.

D22

676. (amended) The method of claim 665, wherein providing heat from the one or more heaters to at least the portion of the formation comprises:

heating a selected volume (V) of the coal formation from the one or more heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons in the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

D23

678. (amended) The method of claim 665, wherein allowing the heat to transfer from the one or more heaters increases a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).

D24

690. (amended) The method of claim 665, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

693. (amended) The method of claim 665, further comprising controlling formation conditions to produce a mixture of condensable hydrocarbons and H_2, wherein a partial pressure of H_2 in the mixture is greater than about 0.5 bar.

695. (amended) The method of claim 665, further comprising altering a pressure in the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.

696. (amended) The method of claim 665, further comprising:

providing hydrogen (H_2) to the part of the formation to hydrogenate hydrocarbons in the part of the formation; and

heating a portion of the part of the formation with heat from hydrogenation.

698. (amended) The method of claim 665, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

702. (amended) The method of claim 665, further comprising providing heat from heaters to at least a portion of the formation, wherein three or more of the heaters are located in the formation in a unit of heaters, and wherein the unit of heaters comprises a triangular pattern.

703. (amended) The method of claim 665, further comprising providing heat from heaters to at least a portion of the formation, wherein the heaters are located in the formation in a unit of heaters, wherein the unit of heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

704. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more heaters to at least a portion of the formation;

allowing the heat to transfer from the one or more heaters to a part of the formation to raise an average temperature in the part of the formation to, or above, a temperature that will

pyrolyze hydrocarbons in the part of the formation;

producing a mixture from the formation; and

controlling an atomic hydrogen to carbon ratio of the produced mixture to be greater than about 1.7 by controlling average pressure and average temperature in the part of the formation such that the average pressure in the part of the formation is greater than the pressure (p) set forth in the following equation for an assessed average temperature (T) in the part of the formation:

$$p = e^{[-38000/T + 61]}$$

where p is measured in psia and T is measured in Kelvin.

5150. (amended) The method of claim 623, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons in the part of the formation.

5151. (amended) The method of claim 623, wherein at least one of the heaters comprises an electrical heater.

5152. (amended) The method of claim 623, wherein at least one of the heaters comprises a surface burner.

5153. (amended) The method of claim 623, wherein at least one of the heaters comprises a flameless distributed combustor.

5154. (amended) The method of claim 623, wherein at least one of the heaters comprises a natural distributed combustor.

5155. (amended) The method of claim 704, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons in the part of the formation.

5156. (amended) The method of claim 704, wherein at least one of the heaters comprises an electrical heater.

5157. (amended) The method of claim 704, wherein at least one of the heaters comprises a surface burner.

5158. (amended) The method of claim 704, wherein at least one of the heaters comprises a flameless distributed combustor.

D29

5159. (amended) The method of claim 704, wherein at least one of the heaters comprises a natural distributed combustor.

5160. (amended) The method of claim 704, further comprising controlling a temperature in at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

5161. (amended) The method of claim 5155, wherein controlling the temperature comprises maintaining a temperature in the part of the formation in a pyrolysis temperature range of about 270 °C to about 400 °C.

D30

5163. (amended) The method of claim 704, wherein providing heat from the one or more heaters to at least the portion of the formation comprises:

heating a selected volume (V) of the coal formation from the one or more heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons in the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

D31

5165. (amended) The method of claim 704, wherein allowing the heat to transfer from the one or more heaters increases a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m ºC).

D32

5177. (amended) The method of claim 704, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

D33

5180. (amended) The method of claim 704, further comprising controlling formation conditions to produce a mixture of condensable hydrocarbons and H_2, wherein a partial pressure of H_2 in the mixture is greater than about 0.5 bar.

D34

5182. (amended) The method of claim 704, further comprising altering a pressure in the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.

5183. (amended) The method of claim 704, further comprising:

providing hydrogen (H_2) to the part of the formation to hydrogenate hydrocarbons in the part of the formation; and

heating a portion of the part of the formation with heat from hydrogenation.

D35

5185. (amended) The method of claim 704, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

5186. (amended) The method of claim 704, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part of the formation is substantially uniform.